# Plant Diagnostics 101 for Landscapers

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Plant Disease and Insect Clinic
Last revision: 26 July 2017

PDIC
Plant Disease and Insect Clinic

NC COOPERATIVE EXTENSION

Part 0

# AN OBSERVATIONAL EXERCISE

Sampson Co, NC. July 2017
Photo: Brad Hardison, NCCES

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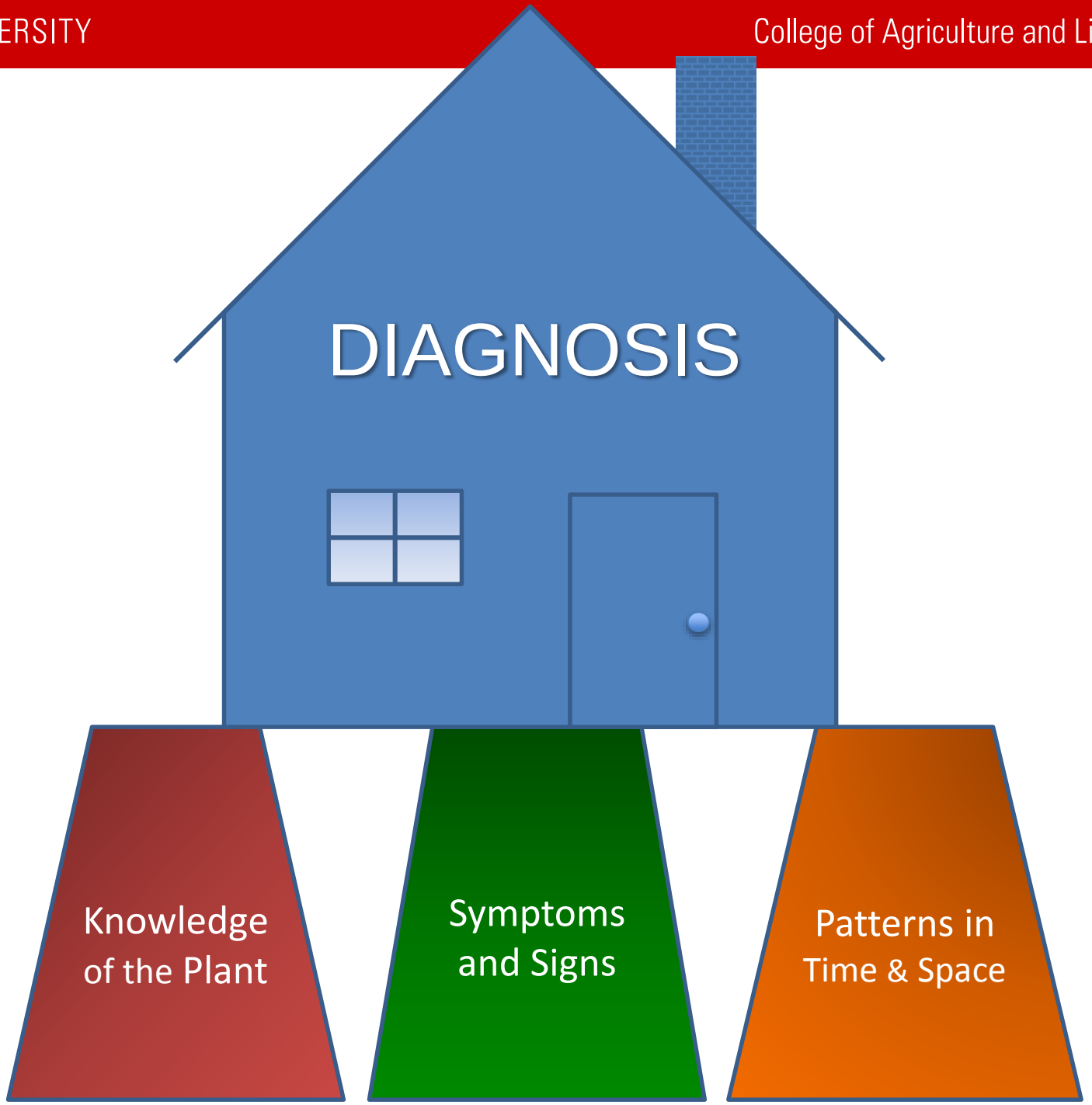
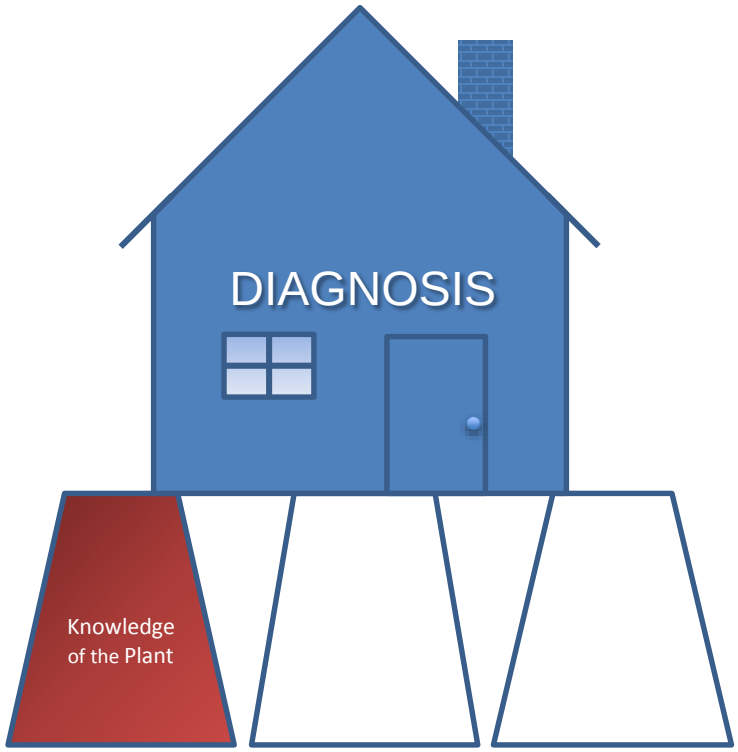
Photo: Brad Hardison, NCCES


DIAGNOSIS
Knowledge of the Plant
Symptoms and Signs
Patterns in Time & Space

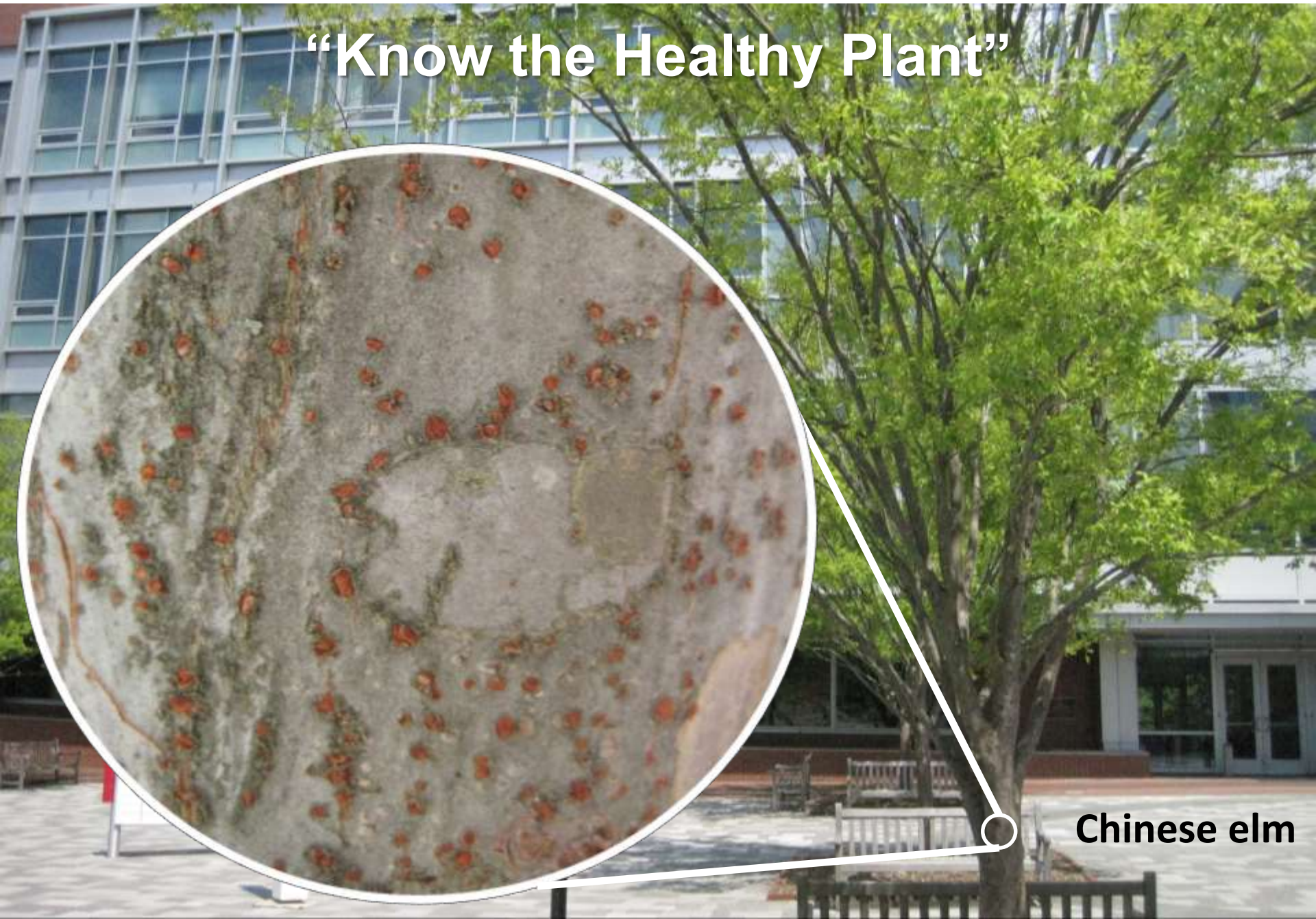



Part 1

# KNOWLEDGE OF THE PLANT

# The First Principle of Plant Pathology

# "Know the Healthy Plant"



# “Know the Healthy Plant”

# Know the Common Issues in Your Area

**Leyland cypress**

- Phytophthora root rot
- Armillaria root rot
- Seiridium canker
- Botryosphaeria canker
- Passalora needle blight
- Internal browning
- Bagworm


Beaufort Co. Mar 2017
Photo: Gene Fox, NCCES


Harnett Co. Aug 2015
Photo: Jeff Morton, NCCES

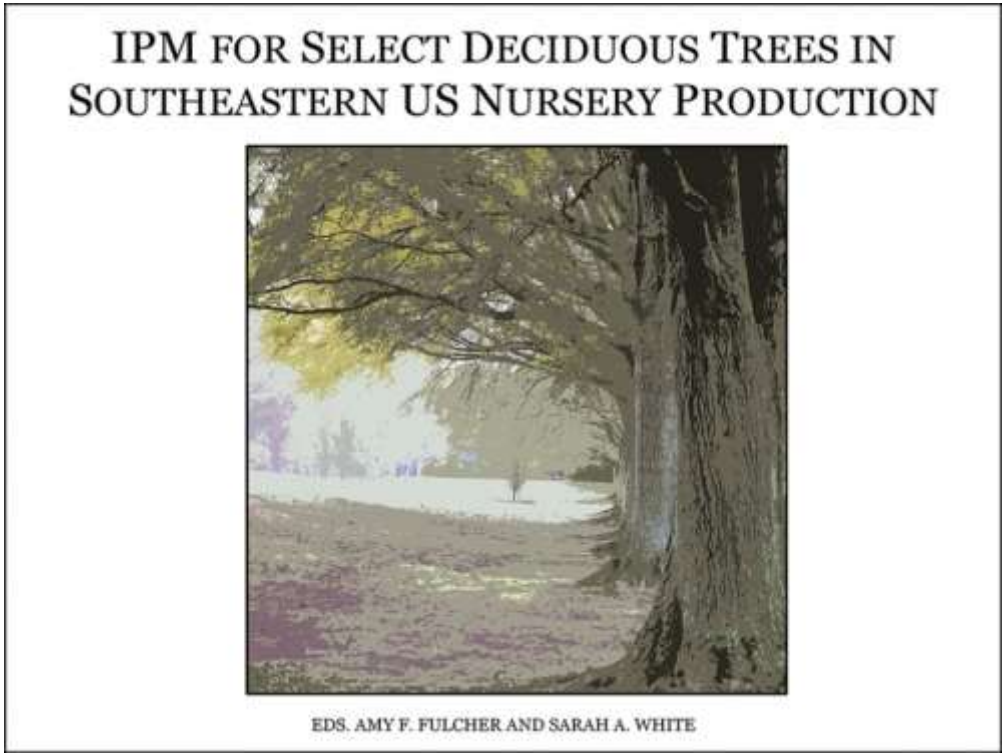
# Diseases Tend to Run in Families


Fire blight: apples, pears, cotoneaster, but NOT stone fruits

# Problems of Cupressaceae in North Carolina

| | Arborvitae | Leyland Cypress | Junipers |
|---|---|---|---|
| Phytophthora root rot | ++ | ++ | ++ |
| Armillaria root rot | ++ | + | ++ |
| Annosum root rot | | | + |
| Seiridium canker | | ++ | |
| Botryosphaeria canker | + | ++ | |
| Passalora (Cercospora) needle blight | | ++ | + |
| Kabatina tip blight | | | + |
| Phomopsis tip blight | | | ++ |
| Gymnosporangium rusts | | | ++ |
| Internal browning | + | ++ | |

# IPM resources for woody ornamentals

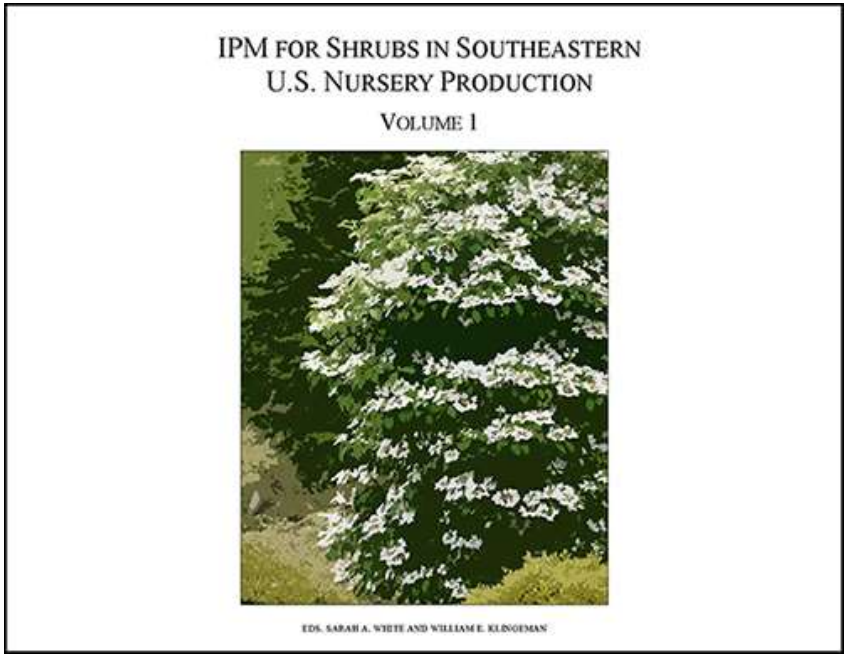



birch, cherry, crapemyrtle, dogwood,
Chinese elm, magnolia, maple, oak, redbud

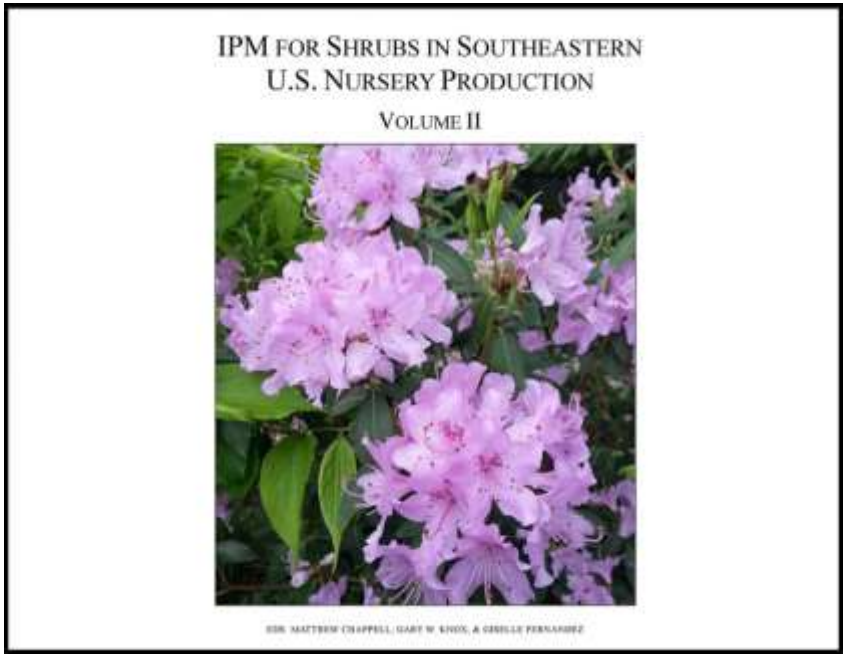
***IPM for Select Deciduous Trees in Southeastern US Nursery Prod'n***

http://wiki.bugwood.org/IPM_book

# IPM resources for woody ornamentals




abelia, camellia, shrub roses, blueberry, viburnum




hydrangea, loropetalum, holly, rhododendron, Indian hawthorn

***IPM for Shrubs in Southeastern US Nursery Production: Vols I & II***

http://wiki.bugwood.org/IPM_Shrub_Book

http://wiki.bugwood.org/IPM_Shrub_Book_II

Part 2

# ABIOTIC DISORDERS *vs.* INFECTIOUS DISEASES

# Pests and Pathogens
## *a.k.a. Biotic Problems*

insects, mites, nematodes, fungi, bacteria, viruses

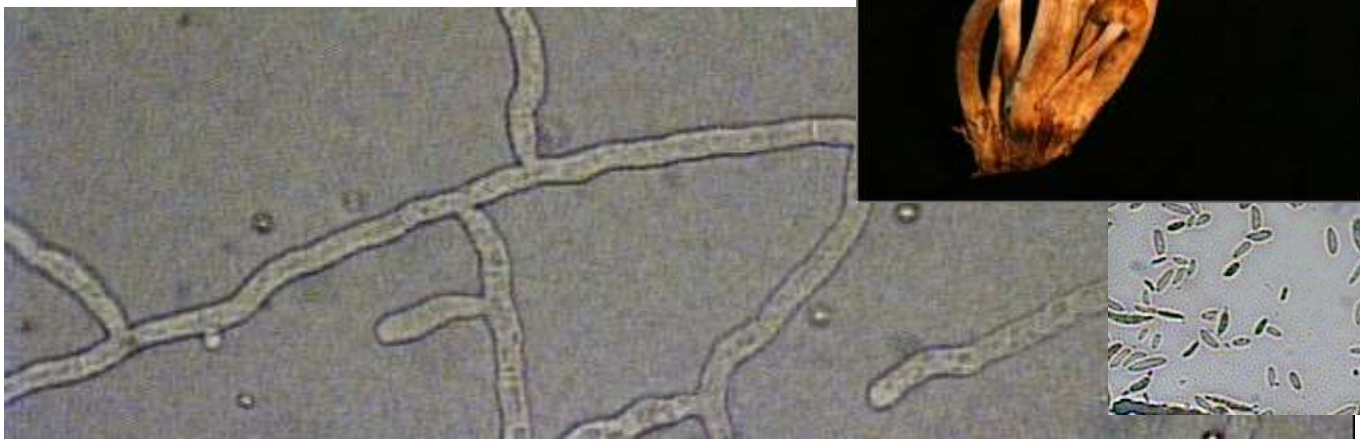
*arthropods*

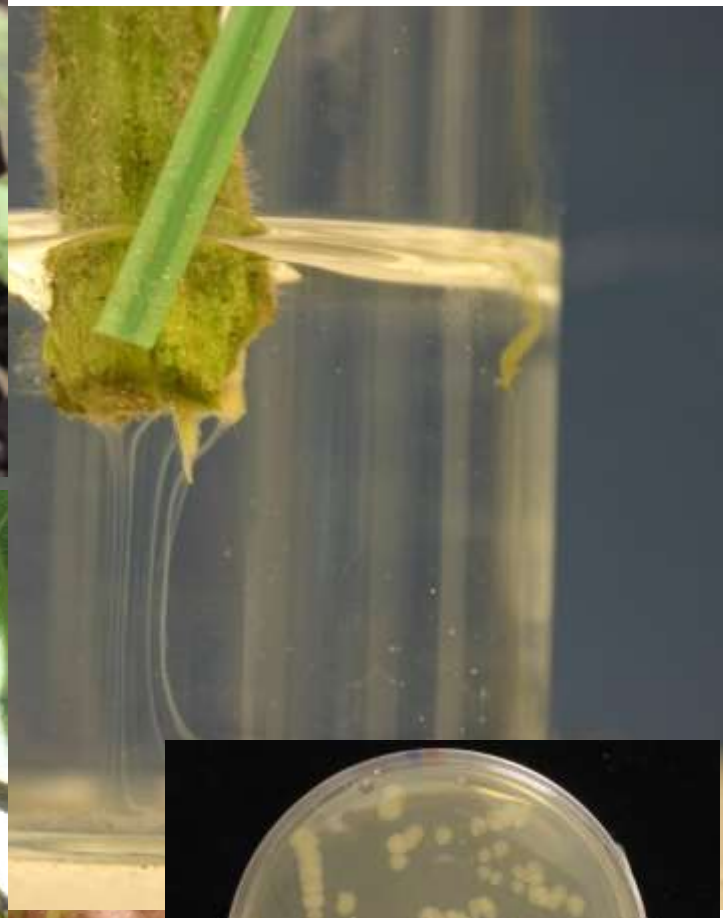
*pathogens*

*animals*

# Fungi

- Largest group of plant pathogens
- “Body” is composed of threads, one cell wide, called *hyphae*.
- Many form macroscopic structures (signs).
- Includes molds, yeasts, mushrooms, water molds*
- Reproduction via spores



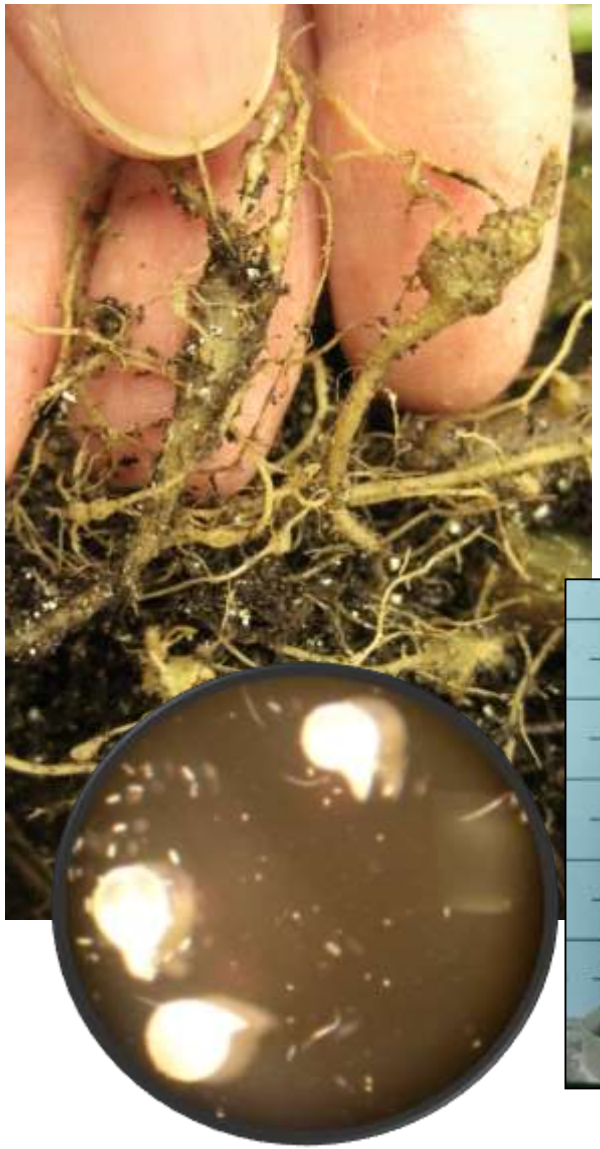


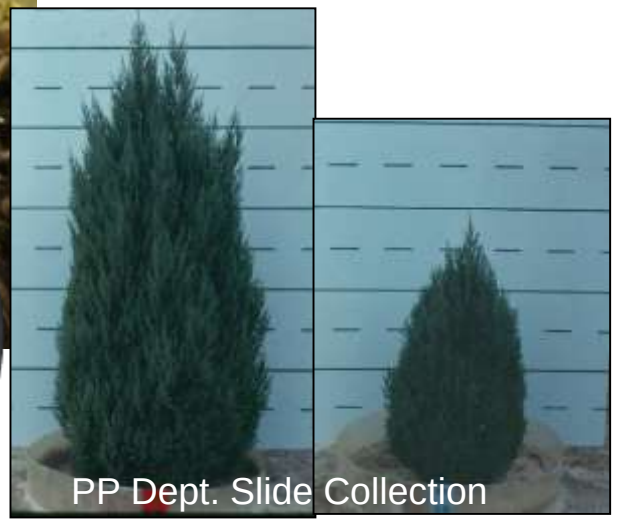
# Bacteria

- Single celled
- Microscopic
- Cause a wide range of symptoms
- Need wounds or natural openings

# Nematodes

- Microscopic roundworms
- Extremely common and abundant but few are plant parasites.
- Most plant pathogenic spp. are root feeders.
- Root lesions or galls … but not always
- Aboveground symptoms reflect loss of root function.





# Viruses

- Submicroscopic particles consisting of DNA or RNA covered by a protein capsid
- Use the host cell's machinery to replicate
- Systemic infections.
- Often vectored by arthropods.

# Abiotic (Noninfectious) Disorders

Freeze injury

Drought

Excess fertilizer

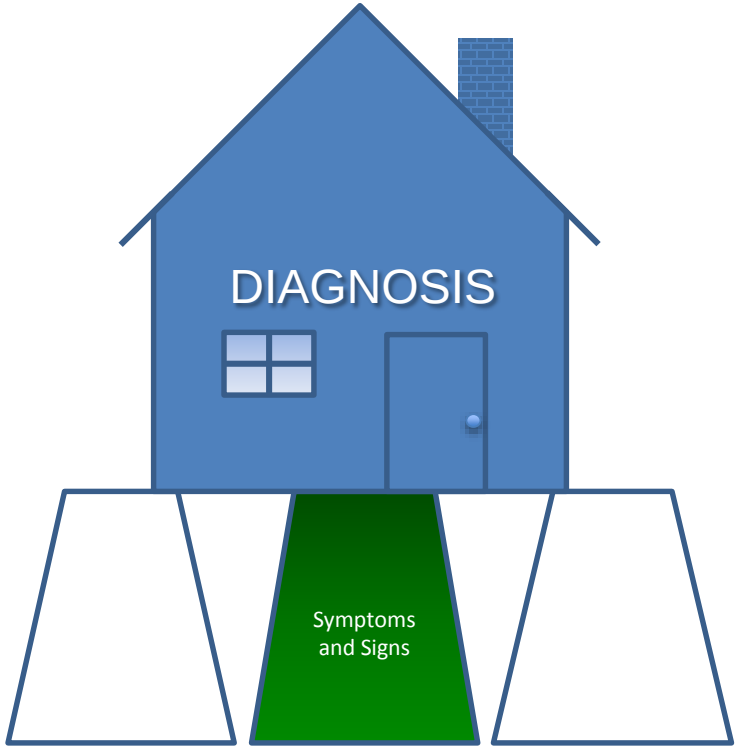
Nutrient deficiencies

High or low soil pH

Improper planting

Herbicide injury

*etc.*

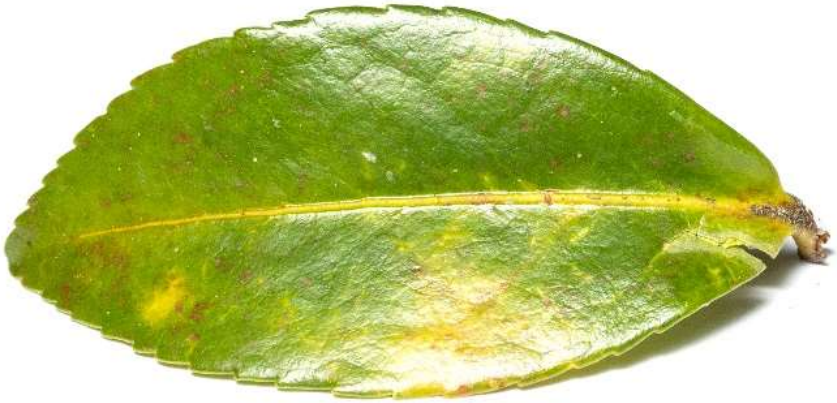


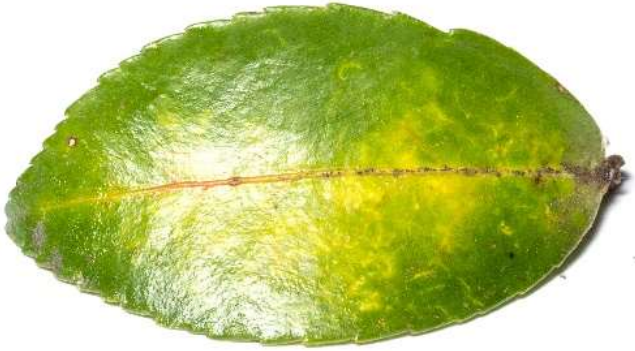

Part 3

# SYMPTOMS AND SIGNS

# Symptom = visible change in a plant due to a disease, disorder, or injury

# Chlorosis (yellowing)



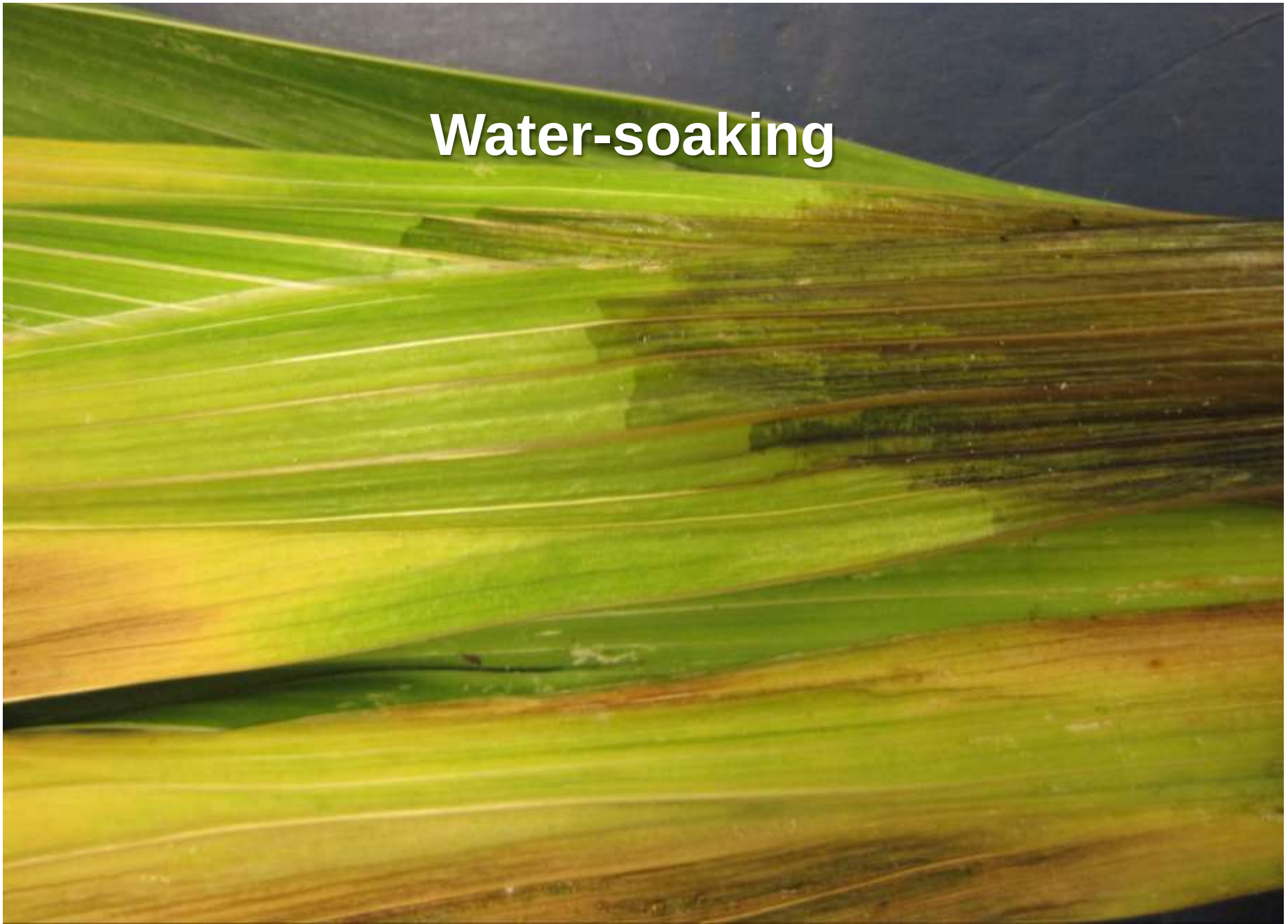



Interveinal Chlorosis


Necrotic (dead) leaf spots

# HOT TIP #1

Look at both sides, and hold leaf up to light.


Water-soaking

# HOT TIP #2

Watersoaked areas (lesions or halos) often indicate a bacterial disease.

# Leaf spots associated with arthropods

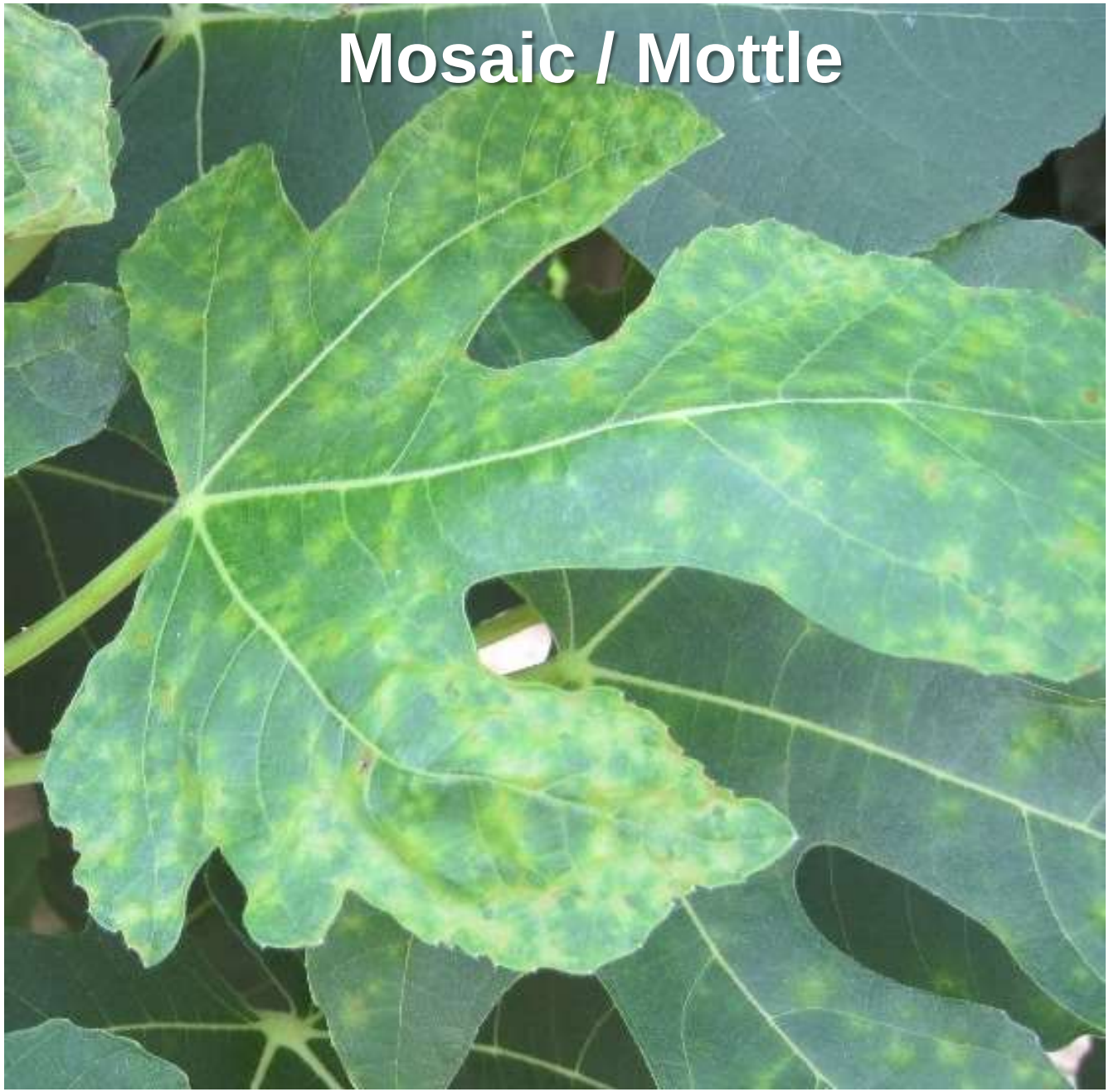

Shot-Hole

# Stippling

# HOT TIP #3

Stippling can have different causes. **Thrips** are messy, leaving numerous dark fecal spots. / **Lace bugs** are messy on the undersides of leaves. / **Leafhoppers** are not messy. / **Mites** leave eggs/shells & shed skins

# Scorch


Mosaic / Mottle


Ringspot

# HOT TIP #4

Many mosaics and almost all ringspots are symptoms of viral disease.

*Caution*: Viruses can cause many other symptoms as well.

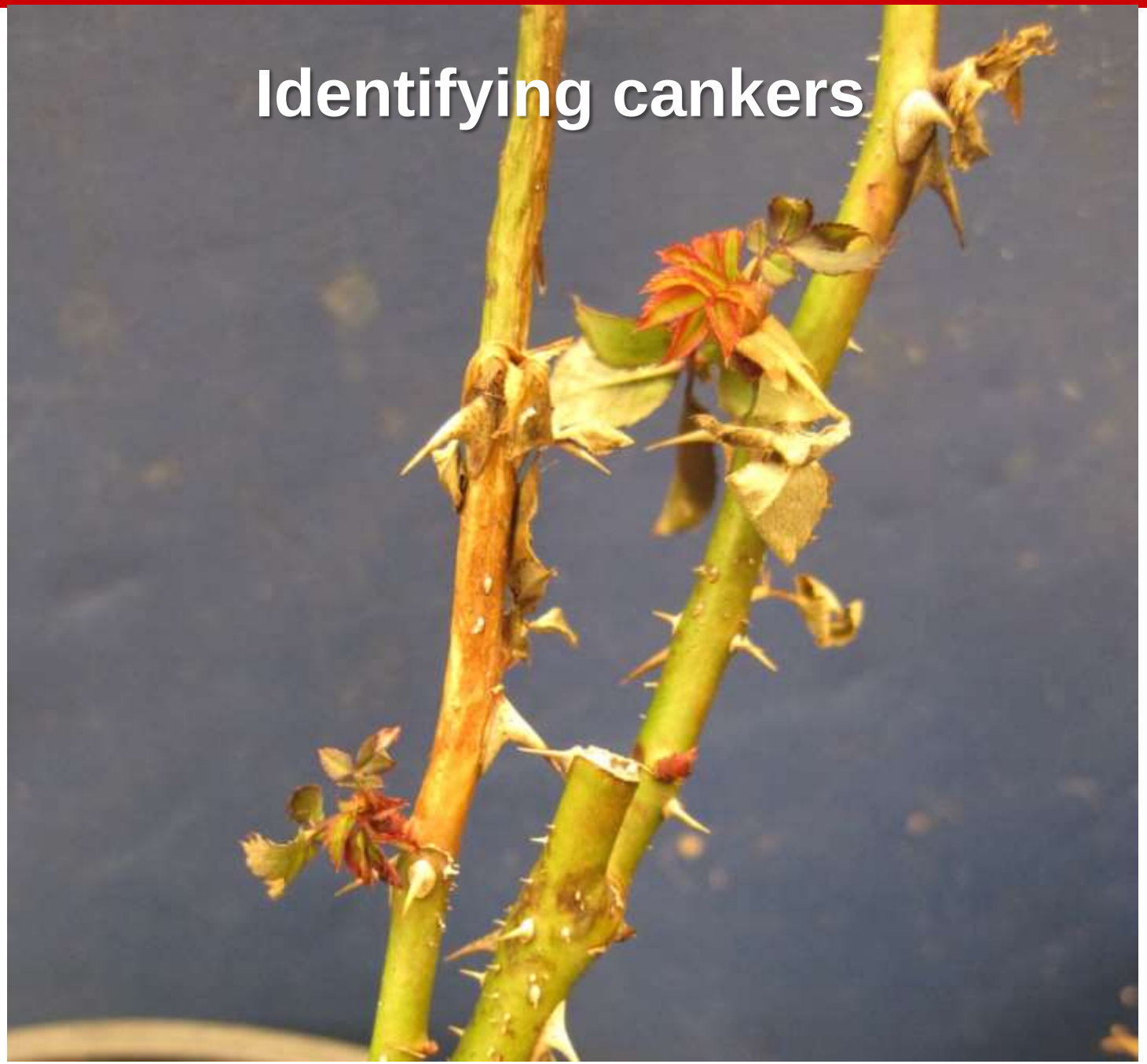
# Dieback

# Canker vs. root rot as causes of wilting and dieback

Photo: Plant Path. Dept. Slide Collection

Photo: Dr. Kelly Ivors

# Identifying cankers



# Identifying cankers

# Identifying cankers

# Wound healing; not a canker

# Identifying root rot

# Identifying root rot

# Defoliation (Leaf Drop)

# Malformation

# HOT TIP #5

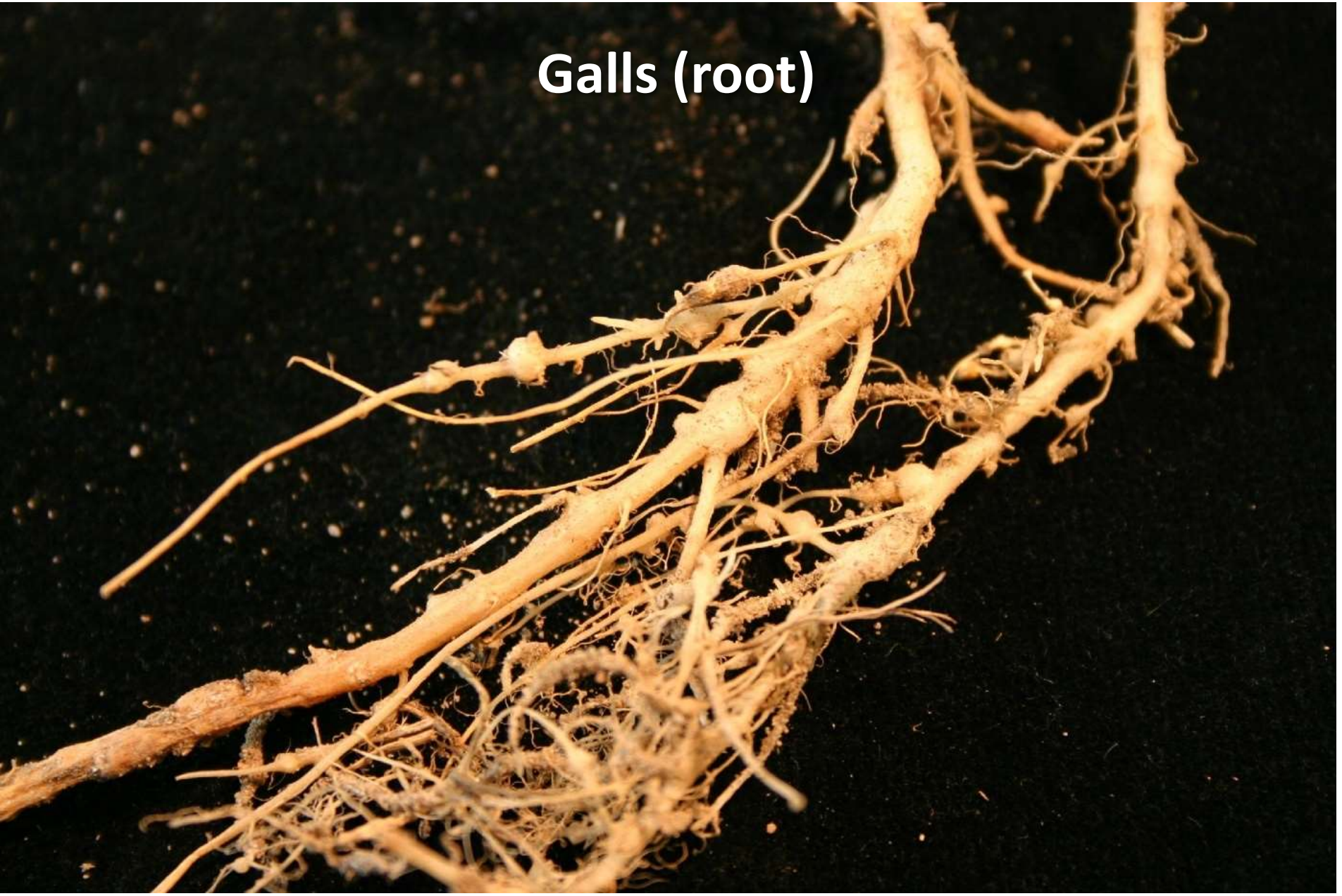
These three things can look similar:

- Some virus symptoms
- Some herbicide injury
- Genetic aberrations
- Some sucking arthropods

# Malformation

# Galls (leaf) … Which one's the insect?

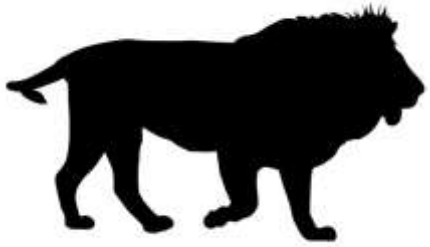
# Galls (stem) … Which one's the insect?


Galls (root)

# Witch's Broom


*visible = with hand-lens or unaided eye

Even if you see a fungus or arthropod, don't assume it's the primary problem.



Ask yourself, "*Is this a lion, or is it a buzzard?*"

# Mycelium / Hyphae

# Fruiting Bodies (mushrooms and conks)

# Fairy Ring

# Rust pustules

# Telia of Cedar-Apple Rust on Juniper

# Case in point: Boxwood blight

- There are three key symptoms of boxwood blight, shown on the next slides.
- If you see any two of the three, you can be reasonably sure of your diagnosis.
- Final confirmation is based on microscopic observation of fungal sporulation, which often requires moist-chamber incubation.

# Boxwood blight: Brown leaf spots

# Boxwood blight: Dark streaks on stems

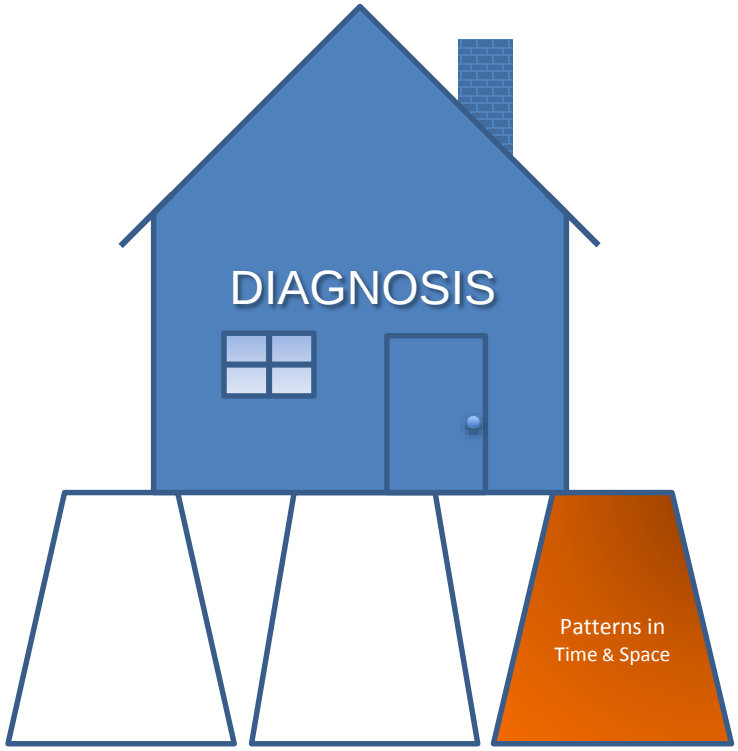
# Boxwood blight: Defoliation

Jackson Co. Sep 2015
Photo: Alan Durden, NCCES


Bottom→Up
Inside→Out
Surry Co., NC. 24 Oct 2012
Photo: Kelly Ivors

# Boxwood blight: 2 of 3 key symptoms

# Boxwood blight: Confirmation




Part 4

# PATTERNS IN TIME AND SPACE

# Patterns in the landscape

A. Uniform *or* many species – suggests abiotic

B. Straight lines or regular pattern – human influence

C. Random – possible disease or insect

   1) Highly mobile, and/or

   2) Just beginning, and/or

   3) Pattern disrupted by transplating

D. Patchy – often a soil-inhabiting pest or pathogen

E. Along edges – pest/pathogen or chemical moving in

# Patterns on the plant

A. Upper leaves
   1) Deficiency of a immobile nutrient?
   2) Virus?

B. Lower leaves
   1) Deficiency of a mobile nutrient
   2) Fungus or bacterium*

C. All leaves
   1) Abiotic factor
   2) Disease in roots or main stem

D. One-sided – vascular wilts, sometimes root rot

E. Individual branches, with sharp transitions – canker

F. Insect Example: branches/crotches = lesser peachtree borer;
   base = peachtree borer

# Note the difference and why…

## Seiridium canker

## Passalora needle blight

# Patterns over time

A. Sudden onset, no progression – *abiotic*

B. Slow expansion of area affected – *likely biotic*

C. Season of onset – *typical of certain pests/diseases*

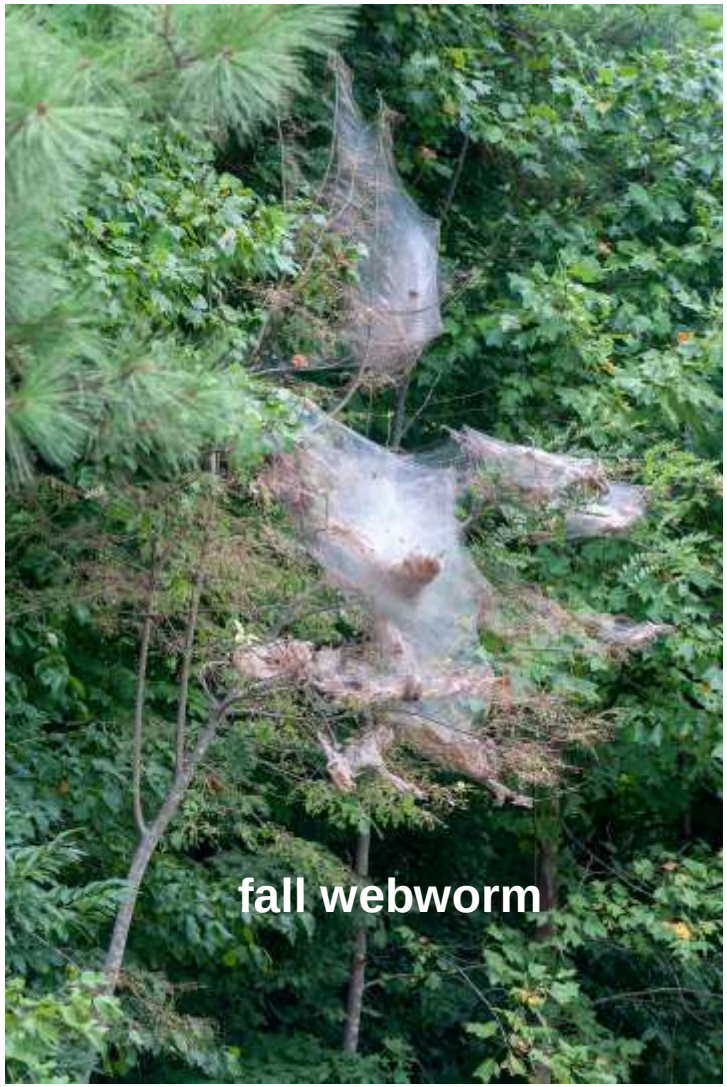
D. From inside→out and bottom→up
*often a foliar infection by a fungus or bacterium*

E. From outside→in and top→down
*possibly root rot, soil problems, abiotic stress*

# Season and Position

spring, crotches

summer/fall, tips

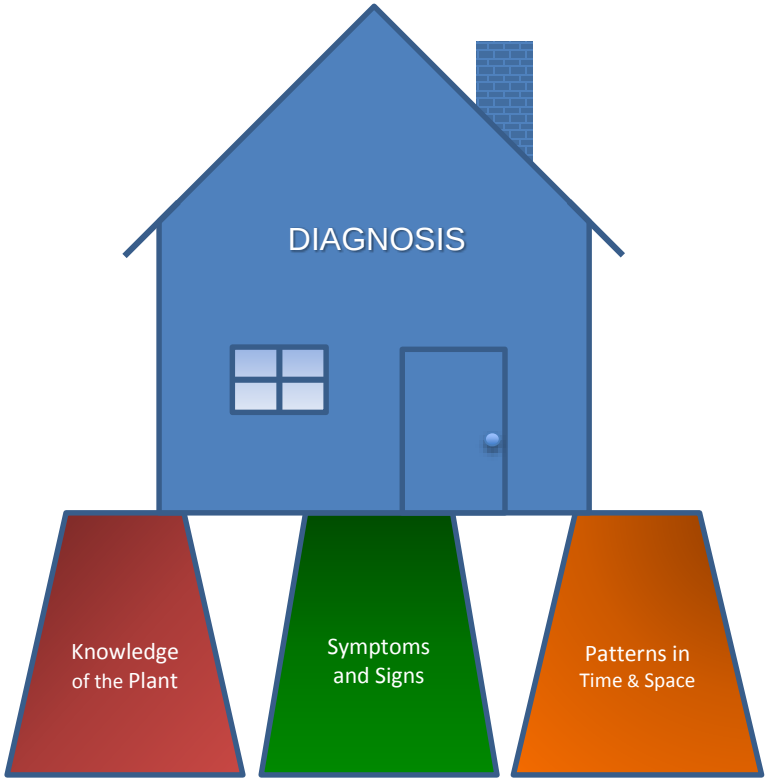

Robert L. Anderson, USDA Forest Service, Bugwood.org

# Redbud tree infected with *Xylella fastidiosa*

16 May 2014

19 Jun 2014

17 Jul 2014




Part 5

# PUTTING IT BACK TOGETHER

# What more do we know about the arborvitae?

Homeowner brought sample to office, and I could not identify any insects or disease under the microscope. Made a home visit for further investigation. Trees began dying last year, and they lost one in 2016. In 2017, two more are infected and one is beginning to exhibit initial symptoms of browning on the bottom. Symptoms begin with browning/dead needles on bottom and work their way up one side of tree. No evidence of herbicide injury. Initial thought was Cercospora needle blight due to spread pattern of dying branches, but could not locate any lesions on stems. Did not identify any insects associated with this sample.

When digging tree, there was plenty of moisture in the surrounding area.

Brad Hardison, Samson Co. CES. July 2017

# Under the bark: *Armillaria*

Part 5

# WHAT TO DO WHEN YOU CAN'T FIGURE IT OUT

# Ornamental Diagnostics at the PDIC

PDIC
Plant Disease and Insect Clinic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Welcome!
The Plant Disease and Insect Clinic diagnoses plant problems for farmers, growers, landscapers, homeowners, and gardeners. In consultation with expert faculty, we recommend ways to treat or prevent the problems we diagnose.
We work in partnership with your local County Agent or Master Gardener, who can diagnose many common plant disease and insect problems, or help you properly collect and submit a sample to the PDIC if necessary. Click these links to find a North Carolinia County Agent and Master Gardener near you!
News & Alerts

# Sample #21325 submitted 01-Jun-2015

blue fortune agastache
little henry rudbeckia
early sunrise coreopsis
jacob kline monarda

all plants show similar symptoms -- scorched leaves, leaf droop, weak stems, black-streaked stems

BONUS

# A FEW EASILY RECOGNIZABLE PROBLEMS

# Entomosporium leaf spot of photinia and Indian hawthorn

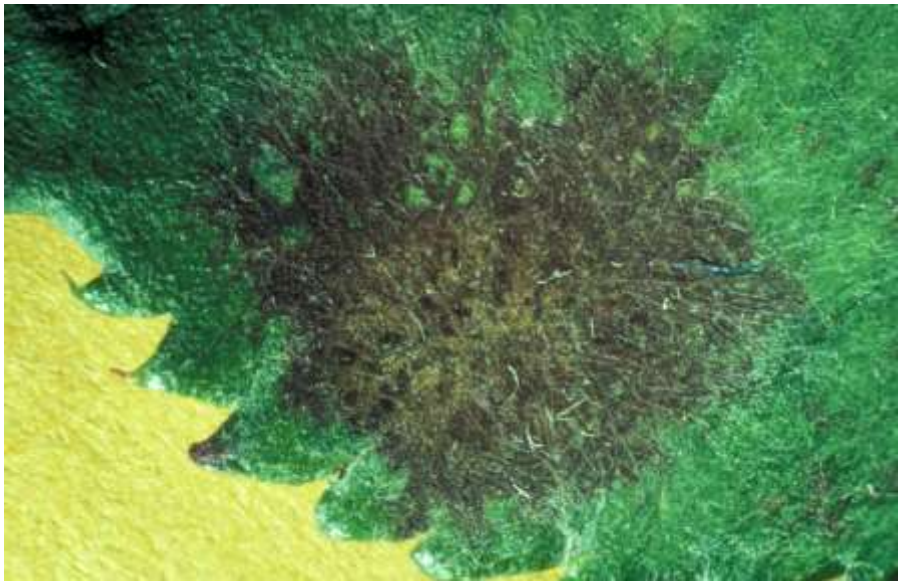
# Powdery mildew fungi on a wide variety of plants

# Quince rust as it appears on Callery pear

# Slime flux of oak and other hardwoods


Photo: Jack Bacheler

# Black Spot of Rose



Photos: Plant Path. Dept. Slide Collection

# The “Dog Vomit” Slime Mold

# *Fuligo septica*, a.k.a. the "dog vomit" slime mold

# IN SUMMARY